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HOSPITAL CHRONICLES 2013, 8(4): 189–191

IMAGES IN MEDICINE

Percutaneous Extraction of Chronically Implanted Left Ventricular Lead Aided by Telescopic Sheaths Spares Patient Major Cardiac Surgery

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A 70-year-old patient was referred from another institution as he had sustained a severe staphylococcal pocket infection of a left-sided biventricular pacemaker system (**Panel A**) implanted 4 years earlier. Patient was offered and opted for a percutaneous approach to lead extraction over open heart surgery. However, use of special locking stylets to facilitate lead traction was hampered by inability to insert the stylets due to mechanical lumen blockage and/or uncoiling and fracture of lead conductors. Hence, the procedure was finally carried out successfully only with use of telescoping sheaths, which facilitated extraction by freeing leads from multiple adhesions along their intravascular and intracardiac course, sparing patient major open cardiac surgery which would have been the only alternative should the percutaneous technique have failed.

Particularly, the left ventricular (LV) lead (**Panel A**, arrow) which was implanted in a coronary sinus tributary and thus considered as associated with the greatest risk during the extraction process, was initially mobilized by pulling the lead into the great cardiac vein (**Panel B**) and then into the right atrium, but it subsequently got entrapped and entangled with the other leads at the level of the superior vena cava, the left innominate and the left subclavian veins (**Panel C**). Use of telescoping sheaths (**Panel C**, arrows) during a tedious, labored and manual pushing and rotating process finally rendered feasible lead extraction after freeing them from multiple adhesions along the way. There was need to use the telescoping sheaths (**Panel D**, arrows) separately for each lead to mechanically disrupt the adhesions and allow for the pulling of the lead with the LV lead being the last to be removed (**Panel D**). Finally, all leads were successfully removed (**Panel E**) via the percutaneous approach. Only a temporary pacemaker wire (tpm) (**Panels B & E**) inserted via the right jugular vein prior to starting the procedure, due to patient's underlying complete heart block and pacemaker dependency, remained to support him during a lengthy hospital stay when he will be receiving an antibiotic course prior to re-implantation of a new pacing system at the contralateral side. **Panel F** shows the explanted LV lead which was finally removed from the endocardial and intravascular space only with the aid of the two (black and white) telescoping sheaths.

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Manuscript received September 13, 2013; revised manuscript accepted September 27, 2013

Conflict of Interest: none declared

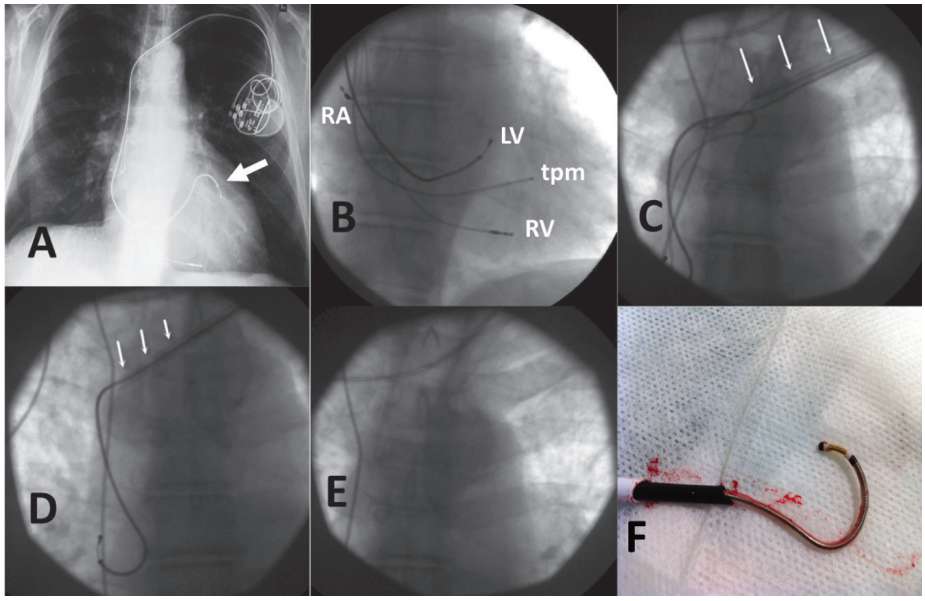

FIGURE 1. See text for discussion. LV = left ventricular; RA = right atrial; RV = right ventricular; tpm = temporary pacemaker (wire).

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Over the last decade the number of implantations of biventricular pacemaker systems for purposes of cardiac resynchronization therapy (CRT) in patients with advanced heart failure has grown considerably.[1] The left ventricular (LV) lead for these systems is positioned within a coronary sinus tributary. Unfortunately, however, together with the increase of implantation of these CRT devices, there has also developed a parallel rising need for CRT device extraction due to complications, mostly due to pocket and/or lead infections and in some cases due to system failure.[2,3] However, removal of such devices is a potentially risky procedure,[2,3] probably of higher risk compared to the risk associated with removal of standard pacing leads implanted at conventional sites in the right heart chambers.[4] The coronary sinus is a fragile thin-walled structure, vulnerable to damage when several extraction tools are used inside the great cardiac vein and its branches. Indeed, several series of patients undergoing percutaneous LV lead extraction, although attesting to the feasibility and high success rate of the procedure, have also reported a distinct increased risk of major complications, including death, cardiac tamponade or other serious bleeding, or cardiac and/or respiratory failure; in certain patients with leads of longer duration since implantation or other predictors, the procedure is more complex and of higher risk.[2,3,5] Explantation is mainly achieved by manual traction, or mechanical dilation or use of laser sheaths. The high cost of the latter being prohibitory, most reports concern the use of mechanical tools, which may limit the success rate of the procedure for complete removal of the pacing system. In a recent report, only a total of 77% of leads were removed using mechanical means while the remaining leads required the use of laser-powered sheaths; a total of 3.5% of leads required intervention, manual dissection or laser-powered dissection, within the coronary sinus with major complications occurring in 1.2% and minor complications in 7.5% of patients.[3]

According to a recently formulated step-wise approach to lead extraction, the use of simple traction with user of either simple or locking stylets considered as the first and second steps,[5] our case, unfortunately, was already beyond these steps from the outset due to lumen blockages, lead uncoiling and/or conductor fractures, probably due to reported prior pocket revisions and/or during their handling in the heavily fibrosed and infected pocket, not permitting the full insertion of stylets. Thus, the third step, that of advancement of telescoping dilator sheaths over the leads and applying counterpressure and countertraction was attempted. As the fourth step, that of powered mechanical or laser sheath use, was not an option and unavailable due to a prohibitory cost, the extraction attempts were concentrated on advancing the dilator sheaths with pushing and rotatory maneuvers to effect disruption of multiple adhesions along the way and render feasible a safe lead extraction, which was finally possible by applying the above described technique. According to a recent report of predictors of advanced lead extraction, age <71 years, implantation time >3 years and presence of multiple leads defined a high-risk group whereby the success of the extraction procedure with use of steps 1-3 was limited to 87%; the major complication rate in that series was reported at 2.4%.[5] Finally, when the approach

from above, i.e. the subclavian route, remains unsuccessful, a femoral approach has been employed complementing the success rate of percutaneous lead removal.[4] Our persistence with the telescoping sheath approach obviated the need for this additional approach which would have prolonged the duration, and have increased the cost and risk of the procedure. However, the greatest benefit offered to the patient with this successful outcome was the avoidance of a major cardiac surgical procedure with open heart surgery and use of extracorporeal circulation, which would have been necessary and the only alternative to finally remove the infected leads should our percutaneous approach have failed.

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